



5 de FEBRERO de 2025

12.00 h

Sala de Grados, Ed. A Facultad de
Ciencias, Campus San Francisco

INMA

Junior

“Amino-yne click chemistry as a tool for the synthesis of stimuli-responsive materials”

Sara Bescós Ramo

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'Click' chemistry refers to a group of efficient, fast, and selective reactions that have emerged as a particularly significant research topic in materials science, enabling the fabrication of materials with tailored characteristics in a simple and effective manner. Among the different possibilities, the outstanding *amino-yne* click chemistry proceeds spontaneously at room temperature by simply combining amines (*amino-*) and electron-withdrawing alkynes, like propiolates (*-yne*). Interestingly, the resultant β -aminoacrylate bond can be cleaved under acidic conditions, allowing for the recovery of the initially conjugated amine. Leveraging these distinctive capabilities, different materials based on β -aminoacrylate cross-links have been approached.

First, we conducted a study on the cleavage of the β -aminoacrylate bond using model molecules. Building on the knowledge gained in this initial step, we then addressed the preparation of PEG-derived hydrogels with potential drug delivery applications, taking advantage of the ability of the *amino-yne* reaction to occur under physiological conditions. Combining a variety of polymer concentrations, a library of amino-based linkers and their integration with β -thioacrylate moieties has enabled precise tunability of material's degradation rates among changes in pH and temperature.

Moreover, the inherently fast progression of this reaction at near-ambient temperatures (30 °C) was exploited to develop a versatile methodology for designing β -aminoacrylate-based liquid crystal elastomers—soft materials that combine elasticity with the anisotropy of liquid crystals. Mechanical actuators with reversible responses to temperature and light, as well as one-way humidity-driven actuation, have been fabricated, which are promising materials for soft robotics.

“Exploiting photopolymerization to modulate Liquid Crystalline Networks actuation”

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Liquid Crystalline Networks (LCNs) are widely investigated to develop soft actuators, ranging from the centimetre to the micrometric scale, and they find application in different fields, such as microrobotics, photonics and even in the biomedical one as artificial muscles. Indeed, thanks to their unique characteristics, combining the entropic elasticity of polymer networks with the orientational order at the molecular level and responsivity of liquid crystals, they can undergo reversible, programmable, and rapid shape changes in response to a plethora of external stimuli, showing kinetics up to the milliseconds time-scale. Light-driven actuators are particularly promising since they can be remotely and precisely controlled, without the need to heat or change the physical-chemical conditions of the external environment. These make them particularly suitable for the obtainment of miniaturized devices and soft robots. Here, different synthetic approaches are presented, leading to thermoresponsive and photoresponsive LCNs with different polymeric architectures. Mixed main-chain/side-chain LCNs obtained one-pot through a thiol-acrylate chain transfer reaction, while main-chain LCNs obtainment is achieved by a two-step approach involving an azo-Michael's addition followed by the acrylate crosslinking. Complete characterization and comparison among the two materials highlighted the superior performances in terms of tension developed upon light-activation of the former one, showing muscle-like force production comparable to standard side-chain LCNs combined with the greater ability to contract from common main-chain LCNs.